

*PEER TUTORING FOR CHILDREN WITH
ATTENTION DEFICIT HYPERACTIVITY DISORDER:
EFFECTS ON CLASSROOM BEHAVIOR AND
ACADEMIC PERFORMANCE*

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We investigated the effects of classwide peer tutoring (CWPT) on the classroom behavior and academic performance of students with attention deficit hyperactivity disorder (ADHD). Typical instructional activities were contrasted with CWPT for 18 children with ADHD and 10 peer comparison students attending first- through fifth-grade general education classes. CWPT led to increases in active engagement in academic tasks along with reductions in off-task behavior for most participants. Of students with ADHD, 50% exhibited improvements in academic performance in math or spelling during CWPT conditions, as measured by a treatment success index. Participating teachers and students reported a high level of satisfaction with intervention procedures. Our results suggest that peer tutoring appears to be an effective strategy for addressing the academic and behavioral difficulties associated with ADHD in general education settings.

DESCRIPTORS: classwide peer tutoring, attention deficit hyperactivity disorder, academic intervention

Children with attention deficit hyperactivity disorder (ADHD) exhibit higher than average rates of off-task behavior in classroom settings, thereby compromising their performance on independent assignments, in group discussions, and in attending to teach-

er instruction (Atkins, Pelham, & Licht, 1985). Given these high rates of inattention to instruction, it is not surprising that one of the greatest risks for individuals with this disorder is academic underachievement (e.g., Barkley, Fischer, Edelbrock, & Smallish, 1990; for review, see Weiss & Hechtman, 1993). Unfortunately, although stimulant medication (the most common and effective treatment for ADHD; Barkley, 1990) has been found to enhance academic productivity, some children with this disorder do not exhibit cognitive improvement as a function of reductions in problem behavior associated

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with pharmacotherapy (Rapport, Denney, DuPaul, & Gardner, 1994; Swanson, Cantwell, Lerner, McBurnett, & Hanna, 1992).

Research conducted in both laboratory and classroom settings has indicated that the academic performance of students with ADHD may be enhanced under conditions of frequent, immediate feedback using individualized academic content presented at the student's pace (cf. Pfiffner & Barkley, 1990). Indeed, behavioral interventions that involve the manipulation of reinforcers typically are recommended for use in home and school settings to ameliorate the symptoms of ADHD (Barkley, 1990; Hinshaw, 1994). Although a recent meta-analysis found that contingency management interventions are effective in improving the classroom behavior of children with ADHD, relatively small effect sizes have been obtained in studies examining the impact of these interventions on academic performance (DuPaul & Eckert, 1997). In particular, academic performance is unlikely to change unless scholastic behaviors (e.g., accuracy on assigned work) are directly targeted for increase via positive reinforcement. An important limitation of contingency management strategies is that teachers and parents may find the procedures less than acceptable because of the time and resources required to implement these interventions (Witt, Martens, & Elliott, 1984). Thus, interventions other than medication and contingency management are needed to address the academic performance deficits of children with ADHD, while taking into account the practical limitations of typical classrooms.

Peer tutoring is an instructional strategy in which two students work together on an academic activity, with one student providing assistance, instruction, and feedback to the other (Greenwood, Maheady, & Carta, 1991). Several models of peer tutoring have been developed that differ regarding instructional focus (acquisition vs. practice), struc-

ture (reciprocal vs. nonreciprocal), and procedural components (e.g., number of sessions per week, methods of pairing students, and type of reward system used; see Fuchs, Fuchs, Phillips, Hamlett, & Karns, 1995). All of these models of peer tutoring share instructional characteristics that are known to enhance the sustained attention of students with ADHD and have been found to increase the on-task behavior of students with attention deficits (e.g., DuPaul & Henningson, 1993; Locke & Fuchs, 1995; Robinson, Newby, & Ganzell, 1981).

Given the limitations of both stimulant medication and contingency management interventions in addressing the academic performance deficits of children with ADHD, the purpose of the present study was to examine the effects of classwide peer tutoring (CWPT; Greenwood, Delquadri, & Carta, 1988) on the task engagement, activity level, and academic performance of 19 children with ADHD and 10 peer comparison students. Based on the results of previous investigations, it was hypothesized that CWPT would lead to higher levels of task engagement, lower physical activity levels, and better performance on weekly posttests relative to typical classroom activities (e.g., completion of independent seatwork to practice skills). Further, it was hypothesized that teachers and students would find CWPT procedures to be acceptable and effective. Finally, it was predicted that the peer comparison participants would also exhibit increases in on-task behavior and weekly posttest performance as a function of CWPT.

METHOD

Participants

Participants attended Grades 1 through 5 in two school districts (one urban, one suburban) in eastern Pennsylvania. A total of 19 students (16 boys and 3 girls) who met the

following criteria were included in the study: (a) teacher and parent complaints of inattentive, impulsive, and highly active behavior; (b) parent report on the Diagnostic Interview Schedule for Children (Fisher, Wicks, Shaffer, Piacentini, & Lapkin, 1992) of clinically significant symptoms of ADHD meeting the criteria of the *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., rev., American Psychiatric Association, 1987) for this disorder; (c) parent and teacher ratings on the ADHD Rating Scale (DuPaul, 1991) indicating the presence of 8 of the 14 symptoms of ADHD to a significant degree; (d) parent or teacher ratings on the Attention Problems subscale of the Child Behavior Checklist (Achenbach, 1991) at or above the 93rd percentile (i.e., 1.5 *SD* above the mean); (e) at least average intelligence (i.e., verbal, performance, or full-scale IQ of at least 80) on the Wechsler Intelligence Scale for Children-III (Wechsler, 1991); (f) not presently on psychotropic medication and not receiving special education services; and (g) written parental consent and verbal consent from the child to participate.

Participants ranged in age from 6 to 10 years of age and were achieving academically in the low average range (see Table 1). Most children were from families in the lower middle socioeconomic class based on parental occupation using the Hollingshead Index (Hollingshead, 1975). Fourteen children were Caucasian, 3 were Hispanic, and 2 were African American. Thirteen children met criteria for oppositional defiant disorder; none met criteria for a conduct disorder. One of the boys dropped out of the project after 2 weeks because his teacher no longer wanted to participate. Thus, 18 of 19 children completed the study.

In addition, 10 peer comparison children were included in the study. These children (a) were matched for gender, (b) were from the same classrooms as participating students with ADHD, and (c) were nominated by

Table 1
Demographic Characteristics of Participants with ADHD (*N* = 18)

| Measure | <i>M</i> | <i>SD</i> | Range |
|-----------------------------|-------------------|-----------|--------|
| Age (years) | 7.7 | 1.3 | 6–11 |
| Grade | 2.2 | 1.1 | 1–5 |
| Socioeconomic status | 35.0 ^a | — | 10–70 |
| CBCL attention problems | 70.4 | 8.1 | 57–84 |
| CBCL-TRF attention problems | 69.4 | 6.7 | 62–84 |
| WISC-III full-scale IQ | 97.2 | 13.7 | 73–120 |
| WISC-III verbal IQ | 97.2 | 14.2 | 65–125 |
| WISC-III performance IQ | 98.5 | 14.2 | 74–130 |
| KTEA math | 97.8 | 14.8 | 77–130 |
| KTEA spelling | 93.4 | 10.6 | 76–116 |
| KTEA reading | 99.9 | 17.0 | 76–140 |

Note. CBCL = Child Behavior Checklist (parent). CBCL-TRF = Child Behavior Checklist-Teacher Report Form. WISC-III = Wechsler Intelligence Scale for Children (3rd ed.). KTEA = Kaufman Test of Educational Achievement (Kaufman & Kaufman, 1985).

^a Median socioeconomic status.

their teachers as average in terms of behavior and academic performance. None of these students had ever been referred for learning or behavior problems. These students did not serve as peer tutors for the students with ADHD during CWPT conditions.

The 18 teachers of the children with ADHD participated in the study on a voluntary basis. These teachers agreed to implement and monitor CWPT procedures in their classrooms, as described below. Teachers determined the peer tutoring pairs for all of the students in their classrooms. Students assigned to tutor the children with ADHD were perceived by their teachers to display a high frequency of appropriate behavior in the classroom and to be on grade level in all academic subjects.

Dependent Measures

Classroom behavior. Direct observations of classroom behavior were conducted to determine the frequency of on-task, off-task, and “fidgety” behavior exhibited by all of the participants with ADHD and 9 of the 10 peer comparison children. A modified ver-

sion of Behavioral Observations of Students in Schools (BOSS; Shapiro, 1996) was used employing the following categories: active on task (e.g., writing or answering questions), passive on task (e.g., listening, watching other students answer questions), off task (visual inattention to one's task materials or the teacher), and fidgets (repetitive, task-irrelevant motor activity). A partial-interval coding procedure was followed, wherein behavior was observed for 15 s with 5 s for recording. Each observation session lasted for 15 to 20 min during academic instruction and related activities (e.g., independent seatwork).

Academic performance. A second set of measures examined academic performance for 14 of the 18 participants with ADHD and all 10 peer comparison participants. On a weekly basis throughout the study, the classroom teacher administered brief pretests and posttests of academic material covered during the week. These tests contained 10 to 20 items and typically took 2 to 3 min to complete. Math tests contained written numerical problems to demonstrate competency in performing the arithmetic operations (addition, subtraction, multiplication, or division) being taught in the classroom. Spelling tests involved the teacher dictating that week's spelling words, with the students providing written answers. Pretests were administered on Mondays prior to instruction, whereas posttests (identical in content to the pretests) were given on Fridays after the day's lesson had occurred. Students completed pretests and posttests independently by providing written responses to each question.

Social validation. Seventeen of 18 participating teachers, 16 of 18 students with ADHD, and 5 of 10 peer comparison students completed consumer satisfaction ratings at the conclusion of their involvement in the study. The teacher rating contained 11 items requesting their perceptions of the impact and practicality of CWPT proce-

dures. Each item was answered on a 3-point Likert-type scale ranging from *not true* to *very true*. Student ratings contained five true-false items assessing the degree to which they enjoyed peer tutoring and believed that it was helpful.

Procedure and Experimental Design

The effects of CWPT were investigated using an ABAB reversal design in 18 classrooms over the course of 2 school years. Specifically, each participant was studied under four conditions: Baseline 1 (typical classroom activities), CWPT 1 (implementation of CWPT in math or spelling), Baseline 2, and CWPT 2. Each experimental condition lasted from 1 to 2 weeks.

For each session, students were observed during academic instruction and related activities (e.g., independent seatwork) in either spelling ($n = 4$) or math ($n = 14$). The specific subject area targeted for intervention was based on the child with ADHD's weakest academic area according to his or her teacher. Observations were conducted across all experimental phases at least three times per week for at least 15 min each.

Baseline. During baseline conditions, the teacher was instructed to conduct class activities as per his or her typical practice during the school year. For all classrooms, these activities included small- and large-group instruction, as well as completion of independent written assignments. Active responding by students was prompted either by asking questions of the group and calling on individual students or by asking all students to complete written work independently. Peer tutoring or other peer-mediated activities (e.g., cooperative learning groups) were not utilized during baseline. No teachers reported using peer tutoring in their classrooms prior to participating in this study. Only two of the participating teachers reported using cooperative learning activities, and these two teachers were asked to refrain from these ac-

tivities during baseline. The only change to the classroom's typical schedule was the inclusion of weekly pretests and posttests, as described above.

Classwide peer tutoring. Teachers were provided with copies of the CWPT manual (Greenwood et al., 1988) and a videotape of a peer tutoring session prior to implementing CWPT in their classrooms. Also, the first author met with each teacher on at least two occasions to review CWPT procedures, answer questions, and model the steps of the intervention. Teachers conducted at least two training sessions with their classes to familiarize students with CWPT procedures. Training sessions were conducted as per Greenwood et al. (1988) and involved the teacher describing and modeling peer tutoring procedures, as well as having the class practice tutoring for about 5 min. Training sessions were conducted during the 2nd week of the initial baseline phase but at a different time of the day than math or spelling instruction.

During CWPT conditions, tutoring pairs worked with each other for 15 to 20 min per day, 3 or 4 days per week, on a specific academic skill (e.g., learning math facts or spelling words). Procedures described by Greenwood et al. (1988) were used during CWPT. The tutor and tutee were seated at separate, adjacent desks and the tutor was provided with a script of academic material (e.g., 10 math problems) related to the current instructional content. Items were dictated one at a time from the script, with the tutee responding orally to the presented item. Two points were awarded by the tutor for each correct initial response. Alternatively, the tutor provided the correct answer when errors were made and the tutee attempted to replicate the correct response three times to earn 1 point. The item list was presented as many times as possible for 10 min. Then, the 2 students switched roles, with the original tutor now receiving in-

struction from the former tutee for an additional 10 min.

During the tutoring sessions, the teacher monitored the behavior of all tutoring pairs and provided assistance, as necessary. Bonus points were awarded to tutorial pairs on a random-interval 5-min basis if proper instructional procedures and behavior control were exhibited. At the conclusion of each 20-min tutoring session, the teacher recorded the number of points earned by each student. To increase adherence to tutorial procedures, each class was divided into two teams, and separate point totals were tallied for each team. At the conclusion of each week, members of the team with the most points were declared the "winners" and were applauded by members of the other team.

Accuracy of CWPT implementation. Accuracy of implementation of peer tutoring procedures was monitored once per week during each CWPT phase (i.e., for 20% of all treatment sessions) by the first author to demonstrate that teachers were able to implement peer tutoring following minimal training. A checklist that included the steps necessary for the teachers and participants to accurately implement CWPT was used wherein each step was coded as present or absent. Teachers and participants accurately implemented CWPT procedures during nearly all treatment sessions. The percentage of peer tutoring steps that were accurately implemented ranged from 82% to 100% ($M = 95\%$) during the initial CWPT phase and ranged from 78% to 100% ($M = 97\%$) during the second CWPT phase. The most frequent procedure that was not implemented was teachers providing feedback and points to tutoring dyads. Teachers were provided with encouragement or modeling as corrective feedback.

Interobserver Agreement

Interobserver agreement was evaluated during 20% of observations across all par-

Table 2
Mean Percentage (Range) of Active On-Task Behavior for ADHD (S) and Peer Comparison (PC) Students

| Participant | BL 1 | PT 1 | BL 2 | PT 2 |
|-------------|------------|-------------|------------|-------------|
| S-1 | 29 (14–64) | 94 (91–100) | 28 (12–61) | 95 (19–100) |
| S-2 | 24 (5–41) | 78 (63–86) | 22 (0–40) | 93 (92–95) |
| S-4 | 25 (17–31) | 91 (87–100) | 21 (9–42) | 85 (75–100) |
| S-6 | 23 (8–48) | 86 (68–96) | 13 (2–26) | 98 (96–100) |
| S-7 | 17 (0–32) | 71 (42–90) | 15 (8–25) | |
| S-8 | 21 (2–33) | 65 (45–85) | 17 (14–20) | 79 (58–90) |
| S-10 | 29 (18–40) | 85 (82–90) | 25 (5–55) | 92 (82–100) |
| S-11 | 42 (12–78) | 94 (90–97) | 5 (0–16) | 94 (90–100) |
| S-12 | 9 (4–22) | 70 (48–85) | 12 (5–22) | 88 (74–100) |
| S-13 | 15 (0–50) | 86 (75–97) | 14 (4–33) | 93 (85–100) |
| S-14 | 33 (26–41) | 90 (78–100) | 22 (3–38) | 87 (81–93) |
| S-15 | 33 (19–76) | 96 (92–98) | 23 (5–42) | 96 (90–100) |
| S-16 | 30 (11–68) | 44 (33–52) | 14 (9–21) | 39 (27–52) |
| S-17 | 16 (5–26) | 82 (74–96) | 13 (2–26) | 85 (78–92) |
| S-18 | 64 (52–76) | 82 (75–90) | 41 (37–43) | 77 (68–85) |
| S-19 | 29 (8–40) | 82 (67–98) | 31 (8–57) | 82 (73–97) |
| S-20 | 56 (38–88) | 87 (83–93) | 35 (30–42) | 87 (78–92) |
| S-21 | 34 | 78 | | 94 |
| PC-11 | 44 | 92 | 15 | 100 |
| PC-12 | 25 | 90 | 13 | 78 |
| PC-13 | 0 | 100 | 50 | 100 |
| PC-14 | 40 | | 20 | 92 |
| PC-15 | 30 | 100 | 15 | 92 |
| PC-16 | 48 | 100 | 50 | 100 |
| PC-17 | 46 | 100 | 27 | 92 |
| PC-18 | | 96 | 78 | 87 |
| PC-19 | 60 | 95 | 44 | 55 |

Note. BL = baseline; PT = peer tutoring.

ticipants and experimental phases as well as for 100% of weekly pretests and posttests. For interobserver agreement sessions, a second observer was present in the classrooms but was located at least 3 m away from the primary observer. Agreement was calculated on a point-by-point basis: agreements divided by agreements plus disagreements with the remainder multiplied by 100%. Kappa coefficients were also calculated for each observation category. Agreement was consistently above 80%, with means of 98% ($\kappa = .89$) for active on task, 94% ($\kappa = .86$) for passive on task, 98% ($\kappa = .92$) for off task, and 99% ($\kappa = .77$) for fidgets. Agreement (between the teacher and a research assistant) for pretests and posttests was determined on an item-by-item basis,

with 100% agreement obtained across all participants and experimental conditions.

RESULTS

CWPT Effects on Active On-Task Behavior

Table 2 presents the means and ranges of active on-task behavior for students with ADHD as well as for peer comparison students. Across students with ADHD, the mean active on-task behavior was 29% (range, 15% to 64%) during the initial baseline condition. During the first CWPT phase, active on-task behavior increased for all participants to a mean of 80% (range, 44% to 96%). The second baseline condition resulted in lower mean active on-task

Table 3
Mean Percentage (Range) of Passive On-Task Behavior for ADHD (S) and Peer Comparison (PC) Students

| Participant | BL 1 | PT 1 | BL 2 | PT 2 |
|-------------|------------|------------|-------------|------------|
| S-1 | 61 (31–78) | 4 (0–5) | 62 (36–80) | 4 (0–9) |
| S-2 | 46 (15–66) | 14 (7–27) | 66 (50–75) | 4 (0–7) |
| S-4 | 63 (49–69) | 7 (0–11) | 55 (26–85) | 13 (0–20) |
| S-6 | 44 (11–67) | 6 (2–8) | 52 (14–80) | 2 (0–4) |
| S-7 | 59 (42–77) | 25 (10–52) | 58 (35–70) | |
| S-8 | 57 (49–68) | 34 (15–55) | 69 (63–76) | 21 (10–42) |
| S-10 | 53 (37–70) | 12 (5–17) | 69 (32–70) | 8 (0–15) |
| S-11 | 37 (11–68) | 3 (0–8) | 77 (62–100) | 4 (0–10) |
| S-12 | 36 (11–55) | 11 (0–32) | 55 (39–78) | 9 (0–26) |
| S-13 | 41 (6–70) | 11 (0–20) | 53 (8–70) | 7 (0–15) |
| S-14 | 38 (23–56) | 7 (0–18) | 60 (42–89) | 12 (6–17) |
| S-15 | 48 (11–62) | 3 (0–6) | 48 (31–62) | 5 (0–10) |
| S-16 | 37 (0–60) | 15 (0–38) | 47 (38–58) | 18 (4–29) |
| S-17 | 50 (35–62) | 10 (3–21) | 64 (51–80) | 10 (6–12) |
| S-18 | 4 (0–12) | 7 (2–15) | 8 (3–18) | 8 (5–15) |
| S-19 | 31 (22–47) | 8 (0–20) | 28 (15–50) | 9 (3–15) |
| S-20 | 29 (10–38) | 6 (3–8) | 53 (35–68) | 10 (0–22) |
| S-21 | 18 | 1 | | 6 |
| PC-11 | 56 | 8 | 6 | 0 |
| PC-12 | 67 | 10 | 87 | 22 |
| PC-13 | 67 | 0 | 44 | 0 |
| PC-14 | 60 | | 73 | 8 |
| PC-15 | 50 | 0 | 77 | 8 |
| PC-16 | 49 | 0 | 40 | 0 |
| PC-17 | 54 | 0 | 73 | 8 |
| PC-18 | | 0 | 11 | 13 |
| PC-19 | 28 | 0 | 40 | 25 |

Note. BL = baseline; PT = peer tutoring.

behavior ($M = 21\%$; range, 6% to 41%) relative to what was exhibited during the initial baseline. A return to CWPT conditions resulted in improvement in active on-task behavior for all individuals ($M = 83\%$; range, 39% to 98%). A similar pattern of results was obtained for the comparison peers, although the latter typically exhibited higher rates of active on-task behavior than did students with ADHD across all four experimental conditions.

CWPT Effects on Passive On-Task Behavior

Table 3 presents the means and ranges of passive on-task behavior for students with ADHD as well as for peer comparison students. The mean percentage of passive on-task behavior was 43% (range, 4% to 63%)

for participants with ADHD during the initial baseline phase. The frequency of this behavior decreased for most participants when CWPT procedures were first implemented ($M = 10\%$; range, 1% to 34%). Removal of CWPT during the second baseline phase resulted in an increase in passive on-task behavior ($M = 56\%$; range, 8% to 77%). The final CWPT phase led to a reduction in this behavior ($M = 10\%$; range, 2% to 21%). A similar pattern of changes in passive on-task behavior was exhibited by comparison peers across experimental conditions.

CWPT Effects on Off-Task Behavior

Table 4 presents the means and ranges of off-task behavior for students with ADHD as well as means of this behavior for peer comparison students. Relatively high rates of

Table 4
Mean Percentage (Range) of Off-Task Behavior for ADHD (S) and Peer Comparison (PC) Students

| Participant | BL 1 | PT 1 | BL 2 | PT 2 |
|-------------|------------|------------|------------|------------|
| S-1 | 6 (0–17) | 1 (0–2) | 11 (4–18) | 1 (0–3) |
| S-2 | 29 (14–44) | 8 (3–14) | 12 (0–26) | 3 (0–5) |
| S-4 | 12 (6–25) | 2 (0–7) | 16 (2–35) | 2 (0–5) |
| S-6 | 34 (14–64) | 8 (0–24) | 34 (10–60) | 0 (0–1) |
| S-7 | 25 (8–33) | 3 (0–12) | 22 (12–47) | |
| S-8 | 17 (2–30) | 1 (0–4) | 14 (10–20) | 0 |
| S-10 | 18 (7–37) | 2 (0–5) | 26 (12–55) | 1 (0–2) |
| S-11 | 20 (7–40) | 2 (0–5) | 17 (0–37) | 1 (0–3) |
| S-12 | 43 (7–85) | 19 (2–44) | 26 (9–53) | 4 (0–11) |
| S-13 | 45 (5–98) | 2 (0–5) | 32 (12–58) | 0 |
| S-14 | 30 (16–42) | 3 (0–17) | 18 (8–33) | 1 (0–3) |
| S-15 | 18 (9–39) | 2 (0–3) | 29 (27–33) | 1 (0–2) |
| S-16 | 33 (12–51) | 41 (29–59) | 38 (21–50) | 44 (42–44) |
| S-17 | 34 (26–46) | 8 (0–14) | 23 (16–35) | 5 (2–10) |
| S-18 | 32 (23–43) | 10 (6–15) | 51 (45–55) | 15 (7–27) |
| S-19 | 30 (19–40) | 10 (2–15) | 42 (28–57) | 10 (0–17) |
| S-20 | 18 (2–37) | 4 (3–10) | 12 (0–35) | 3 (0–8) |
| S-21 | 49 | 0 | | 0 |
| PC-11 | 0 | 0 | 20 | 0 |
| PC-12 | 8 | 0 | 0 | 0 |
| PC-13 | 33 | 0 | 5 | 0 |
| PC-14 | 0 | | 7 | 0 |
| PC-15 | 20 | 0 | 8 | 0 |
| PC-16 | 3 | 0 | 10 | 0 |
| PC-17 | 0 | 0 | 0 | 0 |
| PC-18 | | 4 | 11 | 0 |
| PC-19 | 12 | 5 | 17 | 20 |

Note. BL = baseline; PT = peer tutoring.

off-task behavior were exhibited by students with ADHD during the initial baseline condition ($M = 27\%$; range, 6% to 49%). The initial CWPT condition led to a mean percentage of off-task behavior for participants with ADHD ($M = 8\%$; range, 0% to 41%) that was very similar to the mean of this behavior for peer comparison students ($M = 7\%$; range, 0% to 33%) during the initial baseline. Withdrawal of CWPT procedures led to an increase in off-task behavior for 17 of the 19 students with ADHD ($M = 24\%$; range, 11% to 51%). The second CWPT phase was associated with off-task behavior ($M = 6\%$; range, 0% to 44%) that was very similar to the level of this behavior in peer comparison students during the second baseline phase ($M = 9\%$; range, 0% to 20%). Only 1 student with ADHD (S-16) did not

show consistent decreases in off-task behavior in association with CWPT. As was the case for other behavior categories, peer comparison students showed the same pattern of change in off-task behavior across experimental conditions.

CWPT Effects on Fidgets

Table 5 displays the mean and range of fidgets for students with ADHD and means for peer comparison students across experimental conditions. During the first baseline condition, the mean percentage of fidgets exhibited by students with ADHD was 6% (range, 1% to 20%). The introduction of CWPT procedures led to a reduction in fidgets for 13 of the 18 students with ADHD ($M = 7\%$; range, 0% to 56%). The return to baseline resulted in increases in

Table 5
Mean Percentage (Range) of Fidgeting Behavior for
ADHD (S) and Peer Comparison (PC) Students

| Partici- pant | BL 1 | PT 1 | BL 2 | PT 2 |
|------------------|-----------|-----------|------------|----------|
| S-1 | 11 (1–28) | 17 (0–79) | 4 (2–9) | 6 (0–14) |
| S-2 | 4 (0–14) | 2 (0–7) | 13 (10–16) | 6 (2–14) |
| S-4 | 1 (0–4) | 6 (0–26) | 1 (0–6) | 0 |
| S-6 | 3 (0–18) | 1 (0–3) | 1 (0–5) | 2 (0–6) |
| S-7 | 8 (0–22) | 0 | 0 | |
| S-8 | 5 (0–12) | 1 (0–2) | 10 (0–19) | 5 (0–10) |
| S-10 | 1 (0–2) | 1 (0–2) | 4 (2–5) | 2 (0–7) |
| S-11 | 5 (0–20) | 1 (0–2) | 1 (0–2) | 0 |
| S-12 | 14 (2–37) | 5 (0–25) | 0 | 0 |
| S-13 | 6 (0–13) | 0 | 3 | 0 |
| S-14 | 20 (4–38) | 11 (0–39) | 8 (0–19) | 9 (8–10) |
| S-15 | 4 (0–10) | 0 | 3 (0–6) | 1 (0–2) |
| S-16 | 10 (0–32) | 2 (0–5) | 6 (0–15) | 1 (0–4) |
| S-17 | 9 (0–30) | 13 (0–32) | 5 (2–15) | 0 |
| S-18 | 3 (0–7) | 2 (0–6) | 0 | 1 (0–3) |
| S-19 | 6 (0–17) | 4 (0–7) | 7 (0–15) | 1 (0–2) |
| S-20 | 7 (0–33) | 4 (0–15) | 0 | 1 (0–2) |
| S-21 | 4 | 56 | | 2 |
| PC-11 | 0 | 0 | 0 | 0 |
| PC-12 | 0 | 0 | 0 | 0 |
| PC-13 | 42 | 0 | 0 | 0 |
| PC-14 | 0 | | 0 | 0 |
| PC-15 | 0 | 0 | 0 | 0 |
| PC-16 | 0 | 0 | 0 | 0 |
| PC-17 | 0 | 0 | 0 | 0 |
| PC-18 | | 0 | 0 | 0 |
| PC-19 | 0 | 0 | 2 | 0 |

Note. BL = baseline; PT = peer tutoring.

fidgets for only 8 of the participants with ADHD ($M = 4\%$; range, 0% to 13%). The final CWPT phase was associated with reductions in fidgets for 10 of the students ($M = 2\%$; range, 0% to 6%). Changes in fidgets for the peer comparison students were not obtained, given that most of these students did not exhibit this behavior during any of the experimental phases.

Effects of CWPT on Pretest and Posttest Scores

The mean percentage of accurate responses on weekly pretest and posttests across experimental conditions is displayed in Table 6 for participants with ADHD and peer comparison students. Pretest scores were

Table 6
Mean Pretest and Posttest (in Parentheses) Scores for
ADHD (S) and Peer Comparison (PC) Students

| Partici- pant | BL 1 | PT 1 | BL 2 | PT 2 |
|------------------|-----------|-----------|-----------|-----------|
| S-2 | 100 (100) | 100 (100) | 83 (100) | |
| S-8 | 92 (84) | 100 (100) | 80 (80) | 100 (100) |
| S-10 | 60 (80) | 67 (74) | 72 (78) | 94 (89) |
| S-11 | 12 (48) | 4 (58) | 67 (60) | 60 (73) |
| S-12 | 24 (26) | 22 (22) | 20 | 25 (40) |
| S-13 | 30 (70) | 30 (80) | 0 (50) | 0 (100) |
| S-14 | 61 (52) | 34 (27) | 20 | 28 |
| S-15 | 60 (75) | 50 (55) | 30 (70) | 10 (70) |
| S-16 | 30 (50) | 10 (80) | 22 (22) | 0 (86) |
| S-17 | 85 (92) | 96 (83) | 40 (70) | 80 (80) |
| S-18 | 97 (72) | 56 (42) | 50 (87) | 23 (30) |
| S-19 | 46 (36) | 8 (10) | 12 (20) | 69 (100) |
| S-20 | 52 (64) | 58 (68) | 25 (29) | 48 (76) |
| S-21 | 54 (90) | 64 (88) | 55 (75) | 60 (90) |
| PC-11 | 27 (98) | 30 (100) | 73 (100) | 73 (100) |
| PC-12 | 53 (66) | 70 (78) | 55 | 52 (80) |
| PC-13 | 60 (90) | 25 (95) | 60 (60) | 70 (100) |
| PC-14 | 68 (89) | 76 (65) | 20 | 40 |
| PC-15 | 90 (65) | 60 (70) | 70 (100) | 80 (100) |
| PC-16 | 40 (60) | 100 (100) | 100 (100) | 14 |
| PC-17 | 88 (88) | 82 (97) | 80 (100) | 80 (80) |
| PC-18 | 100 (100) | 100 (100) | 97 (97) | 100 (100) |
| PC-19 | 38 (52) | 32 (78) | 32 (64) | 93 (100) |
| PC-20 | 60 (80) | 74 (82) | 54 (75) | 68 (72) |

Note. BL = baseline; PT = peer tutoring.

higher in CWPT relative to baseline conditions for 7 of the participants with ADHD and 7 of the peer comparison students. There did not appear to be a systematic pattern to changes in pretest scores as a function of experimental condition. The initial implementation of CWPT led to increases in posttest scores for 5 of the 14 students with ADHD and 8 of the 10 peer comparison students relative to the initial baseline. Posttest scores decreased during the return to baseline (relative to the first CWPT phase) for 6 participants with ADHD and 4 peer comparison students. The final CWPT phase led to improvements in posttest scores (relative to the second baseline) for 9 of the students with ADHD and 3 of the peer comparison students. Thus, changes in academic performance associated with ADHD were variable across individuals.

Analysis of Treatment Success and Failure at the Individual Level

To further explicate the effects of CWPT on the academic performance of participants, a determination of treatment "success" and "failure" was made for each individual for whom weekly test data were available using the procedure described by Greenwood *et al.* (1987). Treatment success was delineated by comparing improvement from pretests to posttests during CWPT, relative to concomitant improvement during baseline conditions. Specifically, an index of improvement was calculated for each participant using the following formula: $[(CWPT\ M_{posttest} - CWPT\ M_{pretest}) - (baseline\ M_{posttest} - baseline\ M_{pretest})]$. The two indices of improvement available for each participant (i.e., one index for the comparison of the first phases of baseline and CWPT and another index for the comparison of the second phases of each condition) were averaged to derive a summary index of improvement. The cutpoint for defining treatment success was an index of improvement of at least 10% (Greenwood *et al.*, 1987). That is, pretest to posttest improvement during CWPT conditions must have been at least 10% better than concomitant improvement during baseline phases in order to be defined as a treatment success.

Of the 14 participants with ADHD for whom weekly testing data were available, 7 (50%) students were classified as treatment successes, and the remaining 7 (50%) were treatment failures. More specifically, successful students were those for whom CWPT led to 10% or greater improvement from pretest to posttest relative to concomitant change in scores during baseline conditions. Conversely, only 3 (30%) of the 10 peer comparison participants were classified as treatment successes using the same criterion for index of improvement.

The primary variable associated with

treatment success or failure was the degree to which the student was challenged by the academic material practiced during CWPT conditions. More specifically, of the 7 students with ADHD who were classified as treatment successes, 6 were practicing challenging material (i.e., pretest score <40% accurate; Greenwood, Terry, Arreaga-Mayer, & Finney, 1992). Alternatively, 5 of the 7 children for whom CWPT failed were not challenged by the academic material (i.e., their pretest scores were >40% accurate). All of the peer comparison students were considered to be not challenged using these criteria, including the 3 participants who were classified as treatment successes.

Consumer Satisfaction with CWPT

Consumer satisfaction questionnaires were completed by 17 of the 18 participating teachers, 16 of the 18 students with ADHD, and 5 peer comparison students following the final CWPT phase. Sixteen of the 17 teachers reported satisfaction with peer tutoring, and all 17 teachers indicated that they would continue to use CWPT procedures in some form following termination of the study (see Table 7). In fact, an informal survey indicated that at least 9 of these teachers were using CWPT in their classrooms 6 months after their participation in the study had ceased. Most (11 of 17) teachers reported that some academic improvements were shown by the students with ADHD following CWPT. The majority of teachers also indicated that CWPT was practical and not overly time consuming for use in general education classrooms. Finally, the majority of teachers also reported a preference for CWPT as an academic intervention for students with ADHD relative to currently available treatments including medication, token programs, and time-out.

Of the students who completed the survey, 13 of 16 students with ADHD and all 5 peer comparison students indicated that

Table 7
Results of Teacher Consumer Satisfaction
Questionnaire

| | | |
|--|---------------|-----------|
| The student showed significant improvement in the academic subject in which he or she received tutoring: | | |
| Not true | Somewhat true | Very true |
| 5 | 11 | 1 |
| I will continue to use peer tutoring procedures with this student in some form: | | |
| Not true | Somewhat true | Very true |
| 0 | 8 | 9 |
| I found the manual and meetings with the consultant to be helpful: | | |
| Not true | Somewhat true | Very true |
| 0 | 4 | 13 |
| Monitoring the tutorial sessions was impractical and time consuming: | | |
| Not true | Somewhat true | Very true |
| 11 | 5 | 1 |
| Awarding the points to the student and tutor was helpful: | | |
| Not true | Somewhat true | Very true |
| 2 | 5 | 10 |
| Overall, I am satisfied with the results of peer tutoring: | | |
| Not true | Somewhat true | Very true |
| 1 | 4 | 12 |
| I would recommend this peer tutoring procedure to other teachers: | | |
| Not true | Somewhat true | Very true |
| 1 | 4 | 12 |
| This peer tutoring program is practical and useful for a regular education teacher: | | |
| Not true | Somewhat true | Very true |
| 0 | 5 | 12 |
| Peer tutoring is preferable to other interventions for ADHD such as: ^a | | |
| Medication: | | |
| Not true | Somewhat true | Very true |
| 6 | 4 | 5 |
| Token program: | | |
| Not true | Somewhat true | Very true |
| 3 | 8 | 4 |
| Time-out: | | |
| Not true | Somewhat true | Very true |
| 2 | 7 | 6 |

Note. 17 of the 18 teachers completed the consumer satisfaction questionnaire.

^a Only 15 of the 18 teachers completed this item.

they enjoyed peer tutoring and that they would recommend peer tutoring to a friend (see Table 8). Further, 4 of the 5 peer comparison students and 14 of the 16 students with ADHD believed that CWPT helped

Table 8
Results of Student Consumer Satisfaction
Questionnaire

| Item | Yes | No |
|---|--------|-------|
| I enjoyed peer tutoring. | 13 (5) | 3 (0) |
| The peer tutor helped me to be a better student. | 14 (4) | 2 (1) |
| I would like to have a peer tutor again. | 12 (4) | 4 (1) |
| I would tell a friend to have a peer tutor. | 13 (5) | 3 (0) |
| I liked getting points for giving the right answers. ^a | 13 (5) | 0 (0) |

Note. 16 of the 18 students with ADHD and 5 of the 10 peer comparison students completed the consumer satisfaction questionnaire. The number of ADHD respondents is reported for each item, along with peer comparison respondents in parentheses.

^a 13 of the 18 students with ADHD completed this item.

them to be better students. A similar percentage of both groups of students indicated that they would like to have a peer tutor again. Finally, all of these students liked receiving points for providing correct responses during CWPT sessions.

DISCUSSION

Our results indicate that CWPT increased active engaged time for students with ADHD and reduced their disruptive off-task behavior. Consistent with prior investigations (e.g., DuPaul & Henningson, 1993; Robinson et al., 1981), it is apparent that peer-mediated interventions, like CWPT, can produce significant increases in attention to academic materials, even among children with serious attention and behavior problems. These increases in on-task behavior were similar to those found for children with ADHD treated with methylphenidate (e.g., Rapport et al., 1994), which is considered the most common and effective intervention for this disorder. Similar changes in task-related behavior were obtained for most of the peer comparison students, indicating that it is not the disability that is critical, but how an educational environment is arranged.

The present results extend the findings of previous investigations of peer tutoring for students with ADHD in several ways. First, it was demonstrated that changes in both classroom behavior and academic performance can be obtained with this intervention in general education settings. Further, teachers were able to implement this intervention on a classwide basis at a high level of fidelity with minimal training. Finally, both teachers and students reported CWPT to be an acceptable and at least moderately effective strategy for improving both behavior and academic performance for students with ADHD.

CWPT not only increased task-related attention but also required children to make active responses to academic material. The latter does not necessarily occur in response to other treatments for ADHD (e.g., stimulant medication). Presumably, over time, this increase in active engagement would lead to enhanced academic achievement. In fact, there was an increase in weekly posttest scores relative to baseline conditions for the majority of students with ADHD during the final CWPT phase. An average increase of 22% in weekly test scores (i.e., difference between pretest and posttest scores) was obtained with the implementation of four 20-min CWPT sessions. This change is in contrast to an average gain of 13% in test scores during baseline. Presumably, with long-term exposure to CWPT, even more dramatic gains could be possible, as has been demonstrated with other populations (e.g., Greenwood, Terry, Utley, Montagna, & Walker, 1994).

When CWPT-related changes in the academic performance of individual students with ADHD were examined using the criteria of Greenwood *et al.* (1987), 50% of the sample was classified as showing greater academic success with peer tutoring relative to baseline conditions. The percentage of treatment successes for students with

ADHD was very similar to that obtained by Greenwood *et al.* (1987) for first- and second-grade students who exhibit below-average academic achievement. The degree to which treatment success was demonstrated with CWPT appeared to be related to whether students were practicing challenging material prior to the posttest. Nearly all of the students classified as treatment successes worked on challenging material, whereas all but 1 of the students for whom treatment failed were exposed to less challenging material. Practicing easier material across conditions may have resulted in a ceiling effect, wherein minimal change in posttest scores was evident when comparing CWPT and baseline performance. Future studies of CWPT with this population should ensure that students are exposed to challenging material across experimental conditions.

It is noteworthy that CWPT led to similar behavioral changes in the peer comparison group. In particular, rates of active engagement increased dramatically during this intervention. Weekly posttest scores were higher for some peer comparison students during CWPT conditions, suggesting, at the very least, that the academic growth of these students was not compromised by this intervention. Alternatively, only 3 of the 10 peer comparison students were classified as treatment successes, and all of these students were not challenged by the material. Thus, teachers who implement CWPT should take steps to ensure that the academic material is challenging for most students in the class to enhance the probability that academic benefits will be experienced by as many students as possible.

The present results are limited by several factors. First, weekly pretests and posttests were not collected during the 1st year of the study; thus, a sample of only 14 children with ADHD was included for analyses of these dependent measures. Second, at least one of the teachers reported that peer tutor-

ing was an inefficient use of class time and felt the intervention to be ineffective. Thus, the use of CWPT must be considered in light of teaching style and consumer acceptability.

Peer tutoring may be a useful component of a treatment plan for children who exhibit significant attentional and behavioral difficulties. The behaviors comprising ADHD typically are chronic and significantly debilitating, especially regarding academic achievement. Management of ADHD-related behaviors requires multiple treatment strategies (i.e., stimulant medication, behavior modification) applied over long time periods. Classwide peer tutoring addresses areas of functioning, like academic performance, that are not necessarily enhanced by other treatment modalities. Further research is required to document the effects of this intervention on the long-term academic achievement and peer interactions of students with ADHD.

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STUDY QUESTIONS

1. Why did the authors suggest that procedures other than stimulant medication or contingency management may be needed to improve academic performance of children with attention deficit hyperactivity disorder (ADHD)?
2. What two groups of students participated in this study? In what ways were they similar and different?
3. What were the dependent variables and how were they measured?
4. Briefly describe the experimental design used for evaluating the effects of classwide peer tutoring (CWPT).
5. How was CWPT implemented in this study?
6. What contingencies were implemented by the teachers during the CWPT sessions?
7. What results were generally observed for the ADHD students with respect to the behavioral measures? What differences were observed between these subjects and the matched peers?
8. How were the weekly test scores analyzed, and what did this analysis show?
9. Behavioral changes observed during CWPT were not highly correlated with test score improvement. The authors mentioned that greater test improvement might have been obtained had the students been presented with more "challenging" material. Aside from this change, what procedures could the authors have implemented that might have had a greater effect on academic performance?

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